PATENT SPECIFICATION

DRAWINGS ATTACHED

882,125

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COMPLETE SPECIFICATION

Improvements in or relating to Thread Rolling Machines.

We, MALMEDIE & CO. Maschinenfabrik G.m.b.H., a Body Corporate organised under the laws of Germany, of Königsberger Strasse 87, Düsseldorf, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a machine for the manufacturing of threaded bolts by rolling a cylindrical portion or shank of a blank between a pair of dies separated from each other by a gap, at least one of said dies being connected to a drive adapted to impart a reciprocating movement to it. This well-known technique has the advantage that a considerable number of bolts may be produced within a rather short time. There is, in fact, hardly any limitation with regard to speed, except, however, a limitation existing in the feeding mechanism which serves to forward the individual blanks, one after another, into a position from which they are transferred directly into the die region. There are various types of feeding mechanism in use at present, most of them operating satisfactorily if the speed does not exceed a certain limit. However, these mechanisms tend to fail if an attempt is made to increase the speed above the said limit, that is, if the machine is operated to produce an increased number of bolts per minute. Any failure of the feeding mechanism may result in rather serious trouble, which often requires the disassembling of the die region of the machine.

It is one object of the present invention to provide a blank feeding mechanism for use in a machine of the type referred to which will allow to increase the speed of operation above the limits existing heretofore without the danger of failure occurring.

It is another object of the present invention to provide a blank feeding mechanism for use in a machine of the type referred to which may easily be controlled by the machine operator.

It is a further object of the present invention to provide a blank feeding mechanism for use in a machine of the type referred to which will allow the machine operator to discontinue or interrupt the feeding process instantaneously at any desired moment and also to resume normal operation at any time.

It is a still further object of the invention to provide a blank feeding mechanism for use in a machine of the type referred to which is simple in design, construction, and operation and may be produced at low cost.

According to the present invention, the thread rolling machine has a mechanism for feeding blanks to be rolled into said gap, said mechanism comprising a first channel for said blanks having an output end, a second channel for said blanks, said output end of said first channel laterally opening into said second channel, said second channel opening into said gap, a push rod disposed in said second channel for reciprocating movement therein and adapted to move a single blank from said output end into said gap, said push rod also being adapted to close said output end whenever operating between said output end and said gap, a movable lock member, said lock member when in its operative position being disposed in said first channel adjacent to said output end to prevent any blank except the one closest to said output end from passing into said second channel, means for moving the blank closest to said output end into said channel and drive means for said blank-moving means, push rod and lock member, said drive means being adapted to move said lock member and said blank-moving means into an inoperative position whenever said push rod, while approaching said gap, has closed said output end, and to allow said lock member and said blank-moving means to return into its operative position while said push rod is being retracted, said drive means being in

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Price 33p

synchronised operative connection with said main drive to let any blank being pushed in by said push rod enter said gap when said dies are in a position to start a rolling cycle.

The particulars of the invention will be fully understood from the following description of the embodiment shown in the accompanying drawings. In these drawings

Fig. 1 is a top view of a machine for making threaded bolts and provided with a feeding mechanism according to the invention;

Fig. 2 is an elevation of the machine shown in Fig. 1 as viewed in the direction designated II in Fig. 1;

Fig. 3 is a diagram viewed in direction designated III in Fig. 2, and schematically showing the vital elements of the feeding mechanism;

Fig. 3a is a detail of Fig. 3 illustrating the relative arrangement of the blanks while approaching the rolling zone;

Fig. 4 is a diagram similar to that shown in Fig. 3 with, however, the movable parts of the mechanism appearing in different positions; and

Fig. 5 a detail of the diagram shown in Fig. 3 and 4, however, with the feeding mechanism set at rest.

As shown in Fig. 1 and 2 the machine comprises a rigid frame or bracket 10 and a base plate 12 forming an integral part of frame 10. Of the various components of the machine only those are shown in the drawings and will be described in greater detail which are directly related to the feeding mechanism.

The main drive of the machine comprises a shaft 14 journalled in bearings one of which being shown at 16, shaft 14 having a flywheel 18 keyed to it. Shaft 14 is rotated by an electromotor 19 having a pulley 20 fixed to its axis 21, pulley 20 driving a pulley 22 by means of three belts 23 of the V-type. Belts 23 are shown removed in Fig. 1 to be able to shown the pulleys, pulley 22 driving flywheel 18 through a set of gears contained in a gear box 24. A crank 26 is fixed to flywheel 18 and carries one end of a rod 28, this rod serving to convert the rotation of flywheel 18 into a reciprocating linear motion of a slide 30, the latter running between guide faces 31 and being connected to rod 28 by a pivot 32.

The tools of the machine comprise a pair of dies, 34 and 36, of the flat type, one being movable and the other one being stationary. These dies have ridges worked into one of their flat surfaces, 38 and 40 respectively, these surfaces being arranged opposite and parallel to one another. The ridges may have any desired shape and orientation suitable for thread-rolling, the details in this respect being well known to those skilled in the art and therefore not shown here.

The movable die 34 is housed in a rectangular groove 42 of slide 30. Similarly, a rectangular groove 44 is provided in a support 46 for the stationary die 36. The depth of grooves 42 and 44 is such that the ridges on surfaces 38 and 40 fully extend above slide 30 and support 46, respectively. Means are provided to hold the dies in place, these means being shown to comprise latches 48 and 50 as well as bolts 52 and 54. Adjustment of the relative position of the dies is effected by adjusting support 46. Four set screws 56 are provided for this purpose.

It will be understood that a blank to be threaded will have to be brought into the gap between the faces 38 and 40 of the dies at a time, when slide 30 is in one of its dead center positions, which in the embodiment shown corresponds to the right-hand dead centre of the crank drive 26, 28. During the subsequent motion of die 34 the blank will be rolled between the ridges of the dies and the thread formed in its shank portion, and it will at the same time move to the left in Fig. 1 and drop out of the rolling zone shortly before the crank drive 26, 28 arrives at its left-hand dead centre.

A channel 58, consisting of two parallel bars or rails 60 and 61, is provided as a means to let the blanks approach the die region, and it will be described in detail below how the blanks, having arrived at the output end of channel 58, are forwarded between the dies with proper regard to timing.

Channel 58 serves to keep the blanks of the bolts to be threaded in strict alignment and with their axes in parallel orientation. The blanks generally designated 62 in Fig. 2 and having cylindrical portions or shanks 64 and heads 66, tend to shift downwards along channel 58 in the direction designated in Fig. 2 by arrow 68, their heads 66 contacting one another and being supported by the rails 60 and 61. The sorting and aligning mechanism which in the machine serves to feed the blanks 62 into the input end 59 of channel 58 is not shown and will not be described, such mechanisms being well known to those skilled in the art and not forming any part of the subject matter of this invention. It will suffice to mention that the blanks in an irregular fashion are emptied into a container 70 through an opening 72 which subsequently is closed by a door 74. The sorting and aligning mechanism just mentioned is housed in a section 75 of container 70, and it is actuated by an electromotor 76 including a bevel gear drive inside a box 77, pulleys 78 and 80, and a belt 82.

For adjustment purposes, container 70 is rotatably mounted on a circular plane face 83. After the container has been properly adjusted it may be fixed in position by clamping means not shown.

Other components, of little importance with regard to the invention, are a switch board 84, a lubrication oil pump 86 driven by a motor 88, and a manually operated

wheel 89 for adjustment purposes.

The mechanism for feeding the blanks emerging from channel 58 into the gap 90 between the dies 34 and 36 is shown in detail in Fig. 3 and 4. The presentation in Fig. 3 and 4 is diagrammatical, all those parts and components of the machine which are not directly involved in the operation being omitted. Also all scale considerations have been disregarded in drafting Fig. 3 and 4, in order to be able to demonstrate the operative connections.

A slide 92 is encased in a housing 94 having a lid 93 which in Fig. 3 to 5 is shown taken off. Lugs 95 inside housing 94 serve as guide means for the reciprocating motion of slide 92 in the directions of arrows 96 and 97. A push rod 98 is fixed to slide 92 and extends through an opening 100 of housing 94 into the space in front of the output end 102 of channel 58. Slide 92 is subjected to the opposed actions of a helical compression spring 104 acting upon the rear face 106 of the slide in direction 96, and of a lever 110, acting in the direction of arrow 97, lever 110 being rotatable about a pivot 112 and operated by means of a cam 114 formed on a disc 116. This disc is in synchronized driving connection with the main drive of the machine in such a way that each full revolution of flywheel 18 causes a full revolution of disc 116. The means provided for this purpose comprise: a shaft 118 keyed to disc 116; bevel gears 120; a shaft 122; bevel gears 124; a shaft 126; bevel gears 128; a shaft 130; and a bevel gear drive consisting of a gear 132 fixed to shaft 130 and a gear 134 fixed to shaft 14. With the gear ratio equalling unity in all these bevel gear drives, one revolution of shaft 14 and, consequently, two full strokes of slide 30 carrying die 34 will correspond to one full revolution of disc 116.

It should be mentioned here that in the actual machine the train of gears operatively connecting disc 116 and shaft 14 is contained in gearbox 24 and, as far as the structural details are concerned, is not quite as simple as the schematic presentation in Fig. 3 and 4. However, there is no difference with regard to operation.

Lever 110 contacts a shoulder 136 forming part of slide 92 and is held in constant contact therewith by means of spring 104. Thus, whenever the lever 110 turns counterclockwise it will shift slide 92 in direction 97 and increase the compression of spring 104, while during any clockwise rotation of lever 110 the slide will be shifted by spring 104 in direction 96, the spring also preventing any play or backlash from occurring between the left-hand arm of lever 110 and shoulder 136 as well as between the right-hand arm of lever 110 and cam 114 during normal operation. Push rod 98 will thus move in synchronism with the main drive and, consequently, with die 34.

It is the purpose of push rod 98 to push any blank emerging from the output end 102 of channel 58 into the die region, and it is of importance to note that this pushing action occurs at an acute angle with reference to the direction of the motion of die 34, this angle being shown in Fig. 1, and being designated B.

A lock member is provided which, when in operative position, prevents the blanks from emerging at the output end 102 of channel 58. In the embodiment illustrated in the drawings this lock member comprises a wedge 138 fixed to an arm 140 journalled at 142 and being under the action of a wire spring 144, the latter tending to turn arm 140 in counterclockwise direction if viewed as in Fig. 3 and 4. Arm 140 is controlled by slide 92 and is provided for this purpose with an abutment pin 146, the latter being actuated by an oblique face 148 of slide 92. In the position shown in Fig. 3, arm 140 is in its operative or locking position, closing the output end 102 of channel 58, wedge 138 resting against rail 60 with as much pressure as spring 144 provides. In Fig. 4, however, arm 140 is shown in its inoperative or release position, into which it has been turned by spring 104 through slide 92, face 148 and pin 146.

Channel 58 opens into a short channel 150, formed by an inclined extension 152 of rail 61 and an oblique face 154 of support 46. The short channel 150 has a width equalling that of channel 58 and is in alignment with push rod 98. It serves to guide the blanks during their travel from the output end 102 of channel 58 to the die region, as will be described in detail below.

Turning now to Fig. 4 and 5 it will be noted that housing 94 of slide 92 has a lateral extension 156 of cylindrical cross section and housing a cylindrical plug 158. This extension is shown sectioned longitudinally in Fig. 3 to 5. A shank 160 is fixed to the rear end face 159 of plug 158 and extends through a hole 162 in the wall of extension 156. Shank 160 has a handle 164 fixed to it. A helical spring 166 is disposed between the said end face 159 and the wall of extension 156 and tends to shift plug 158 in the direction of arrow 168, i.e., into the path of slide 92. Plug 158 has at its front end a shoulder 170, best seen in Fig. 5, shoulder 170 having a straight face 172 and an inclined cam face 174. Slide 92 has a shoulder 176 similar in shape to shoulder 170, its straight face 178 and its inclined cam face 180 corresponding to and lying parallel with faces 172 and 174, respectively, of shoulder 170.

Handle 164 allows the operator to turn the cylindrical plug 158 about its axis and also to exert a pull for moving the plug in the direction of arrow 169. Furthermore, in cooperation with the end face 182 of the lateral

extension 156 of housing 94 having a recess 184, handle 164 also serves as a means to fix plug 158 in either the position shown in Fig. 3 and 4 or the position shown in Fig. 5, as will be clearly understood from the drawings. Thus, in the position shown in Fig. 3 and 4, plug 158 is entirely outside the path of slide 92 and shoulder 176 and does not interfere with the reciprocating motion of said slide, being held in this position by handle 164 resting against face 182. In the position in Fig. 5, on the other hand, shoulder 170 reaches into the path of shoulder 176 without, however, contacting the lateral face 186 of slide 92, so that there will be some clearance between the respective parts as indicated at 188. In Fig. 5, slide 92 is shown in the one of its two extreme positions which corresponds to maximum compression of spring 166, and it should be noted that in this particular position the straight faces 172 and 178 of shoulders 170 and 176 do not contact each other, a very small gap 190 separating them.

With all the vital elements of the machine now having been described the way in which it is operated will be easily understood.

In order to prepare the machine for operation, proper dies are selected first from stock to correspond with the type and size of thread to be rolled. The dies selected are then secured to slide 30 and support 46 respectively as dies 34 and 36, and the gap 90 between them is subsequently adjusted properly by means of the set screws 56. Container 70 is filled with the respective blanks through opening 72 which opening is then closed by door 74. Adjustment of the track, or clearance between rails 60 and 61 and between extension 152 and oblique face 154, is only necessary if the shank diameter of the blanks is greater or the head diameter of the blanks is less than the existing clearance. Motor 76 is then started to actuate the sorting and aligning mechanism by whose action the blanks will be caused to enter channel 58 one after another in the manner illustrated in Fig. 2.

In a top view the blanks in channel 58 will present their heads to the observer. However, operation will be better understood if the shank portions of the blanks are considered instead of the head portions. It is for this reason why in Fig. 3 and 4 the heads are shown severed, the remaining shanks being shown crosshatched.

The first blank emerging from the sorting and aligning mechanism will glide down in channel 58 under the action of its weight and, as long as the main drive is still at rest, come to a standstill near the output end 102, the shank of this blank being stopped either by wedge 138 if the latter is in its operative position shown in Fig. 3, or by the lateral face 192 of push rod 98 if wedge 138 is in its inoperative position shown in Fig. 4. Any further blank gliding down along channel 58 will be stopped by its head 66 hitting the head of the preceding blank, the relative position of two blanks being illustrated in Fig. 3a.

As soon as channel 58 is at least partly filled with blanks the main drive of the machine may be switched on to start the reciprocating motions of slide 30 carrying die 34 and of slide 92 carrying push rod 98. Suppose now that all parts are in the position shown in Fig. 4, plug 158 being retracted, wedge 138 being in its inoperative or release position and the first blank being in the position designated " a " and followed by blanks being in positions designated " b " and " c ", there being no blank, however, in the position designated " d ". If now slide 92 is shifted in direction 97 its face 148 will release pin 146, thus causing spring 144 to turn arm 140 counterclockwise until the oblique face 139 of wedge 138 presses against the blank being in position " a " without, however, being able to move this blank before push rod 98 has moved back sufficiently to open the output end 102 of channel 58. However, as soon as this happens the blank in position " a " will instantaneously be moved into position " e ", shown in Fig. 3, all other elements now having arrived in the positions shown in Fig. 3, except that there is no blank yet in the position designated " f ". In position " e " the blank will find itself right in front of the end face 194 of push rod 98, and it should be noted that in Fig. 3 slide 92 is shown in its extreme retracted position.

While channel 58 is sufficiently inclined to allow the blanks to glide downward under their own weight, the short channel 150 is only slightly inclined, so that a blank in position " e " will be forwarded to position " d " not by its weight but by the positive action of push rod 98. At the same time, wedge 138 prevents any blank other than the one formerly in position " a " from entering channel 150. Wedge 138 will thus allow the following blanks to glide down by a short distance only, the blank formerly in position " b " now reaching position " g " and being stopped by the wedge.

While a blank is travelling from " e " to "d " under the positive action of push rod 98, face 148 through pin 146 and arm 140 will again release wedge 138, so that the blank which initially was in position " b " will now move into position " a ", the next following blank moving to " b ", etc.

A blank arriving in position " d " will find the dies in a position ready to start rolling, crank drive 26, 28 just passing through its dead centre position at this instant and the instantaneous velocity of die 34 thus equalling zero. Push rod 98 is controlled to push the blank over the total distance from " e " to " d ", the force of spring 104 finally pressing the blank between the ridges of the dies, as is

illustrated in Fig. 4. The blank is thus prevented from moving back before it is caught and held by the grip of the dies when the rolling is started.

The process just constituted represents a full cycle. It will be understood that channel 150 will at no time contain more than one blank and that, due to the synchronized positive action of push rod 98, any blank will always enter the rolling zone, or gap 90 between the dies, at the proper time, neither too early nor too late. The presence of a blank between the dies in position "f" in Fig. 3 indicates that die 34 is at that particular instant moving from right to left, and that it will thus have to complete one half stroke in that same direction in addition to a full stroke in the opposite direction before reaching the position shown in Fig. 4. Push rod 98, on the other hand, is already in the position to start its pushing action. There is, consequently, a rather long interval of time available for the push rod to complete its pushing action, and this is one of the reasons why the feeding mechanism according to the invention may be operated at very high frequencies and in combination with machines of greatly increased output per minute.

It is an important feature of the mechanism described above that the wedge 138, when moving from the position shown in Fig. 4 towards that shown in Fig. 3, with push rod 98 still closing the output end of channel 58, will enter the space between the shanks in positions "a" and "b". The wedge will thus separate the first and only the first blank from the rest of blanks in line in channel 58. In order to accomplish this the wedge is so disposed that its oblique face 139 when entering the said space will face the shank of the blank in position "a" while the rear face of the wedge will lie opposite the shank of the blank in position "b".

Trouble sometimes is experienced in most types of thread rolling machines if the shank diameter of a blank is not inside the prescribed tolerances. It is then necessary to interrupt feeding. In the machine described here this interruption is done by turning handle 164 of plug 158 into a position registering with recess 184. Shoulder 176 will then be caught and engaged by shoulder 170 before a further full cycle is completed, and the push rod will thus come to a standstill in its retracted position, except for a small rocking motion to the extent of the width of gap 190. With the feeding thus interrupted before a further blank enters the die region or rolling zone the operator may eliminate the cause of trouble. Sometimes he may be able to do so even though die 34 continues moving. In any event, because of the considerable inertia involved, the flywheel and parts operatively connected to it could not be put at rest without delay.

After the cause of the trouble has been removed, feeding may be resumed by pulling out plug 158. In order to ensure smooth action free from undesired jerks, the operator is prevented from pulling plug 158 except at a time when the mechanism is in a phase in which, under normal feeding operation, slide 92 would be fully or nearly fully retracted. This is accomplished by spring 104 producing a force which, whenever shoulder faces 172 and 178 are in contact, acts upon plug 158 in an asymmetrical fashion and thus generates considerable pressure between the cylindrical surface of the plug and the wall surrounding it, the resulting friction exceeding the manual force of the human operator, a condition easily established by suitably dimensioning spring 104.

Only during the brief intervals in which slide 92 is moved by lever 110 beyond the position in which the faces 172 and 178 contact each other, with the gap 190 appearing between them and the said friction dropping to zero, will the operator be able to pull plug 158 and let slide 92 resume its operation. However, even though these intervals of time will be short the operator will have no difficulty in catching the proper moment because all he has to do is to exert a constant pull at handle 164 until the opposing frictional resistance disappears and the pull causes the removal of shoulder 170 from the path of shoulder 176.

WHAT WE CLAIM IS:—

1. A thread rolling machine having a pair of rolling dies separated from each other by a gap, at least one of said dies being movable and operatively connected to a main drive adapted to impart to said movable die a reciprocating movement, said thread rolling machine also having a mechanism for feeding blanks to be rolled into said gap, said mechanism comprising a first channel for said blanks having an output end, a second channel for said blanks, said output end of said first channel laterally opening into said second channel, said second channel opening into said gap, a push rod disposed in said second channel for reciprocating movement therein and adapted to move a single blank from said output end into said gap, said push rod also being adapted to close said output end whenever operating between said output end and said gap, a movable lock member, said lock member when in its operative position being disposed in said first channel adjacent to said output end to prevent any blank except the one closest to said output end from passing into said second channel, means for moving the blank closest to said output end into said channel and drive means for said blank-moving means, push rod and lock member, said drive means being adapted to move said lock member and said

blank-moving means into an inoperative position whenever said push rod, while approaching said gap, has closed said output end, and to allow said lock member and said blank-moving means to return into its operative position while said push rod is being retracted, said drive means being in synchronised operative connection with said main drive to let any blank being pushed by said push rod enter said gap when said dies are in a position to start a rolling cycle.

2. A thread rolling machine as claimed in claim 1, in which said lock member and said blank-moving means are combined to form a single member.

3. A thread rolling machine as claimed in claim 2, in which said single member is wedge-shaped.

4. A thread rolling machine as claimed in any one of the preceding claims, in which said push rod is spring-driven in its pushing direction.

5. A thread rolling machine as claimed in claim 4, in which means is provided to lock said push rod in a position close to but not entirely coinciding with its fully retracted position, said means including a plug mounted for being moved transversely into the path of a lug mounted on said push rod.

6. A thread rolling machine as claimed in any one of the preceding claims, in which said lock member when approaching the locking position is spring-driven.

7. A thread rolling machine as claimed in any one of the preceding claims, in which said blank-moving means, while acting upon a blank, is spring-driven.

8. A thread rolling machine substantially as described with reference to the accompanying drawings.

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Fig. 1

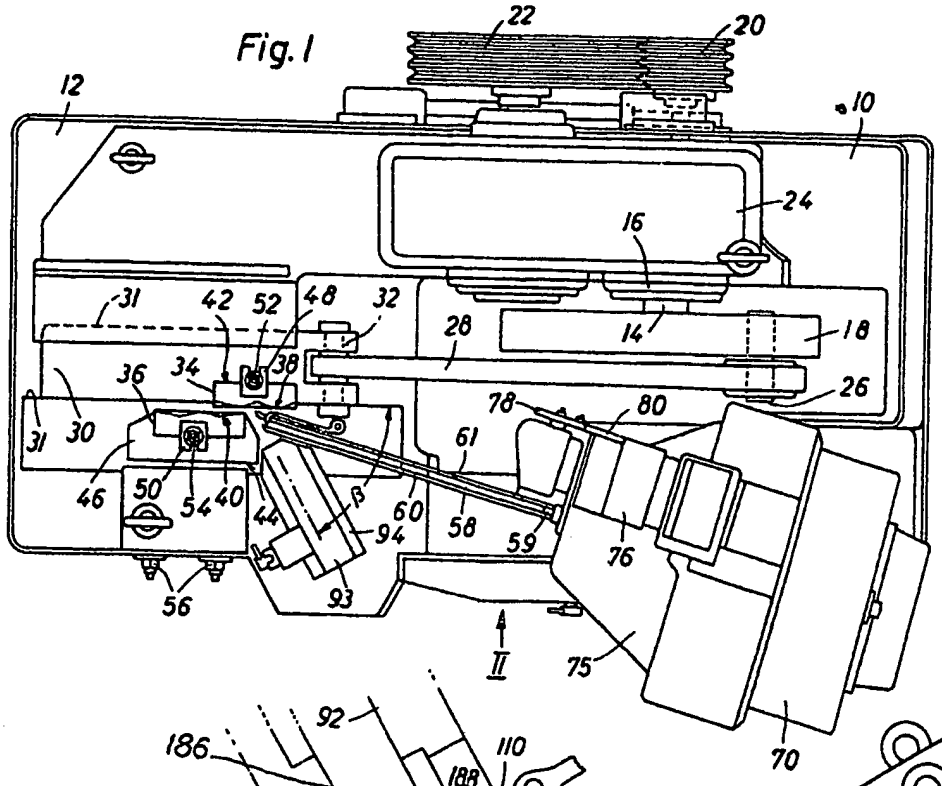
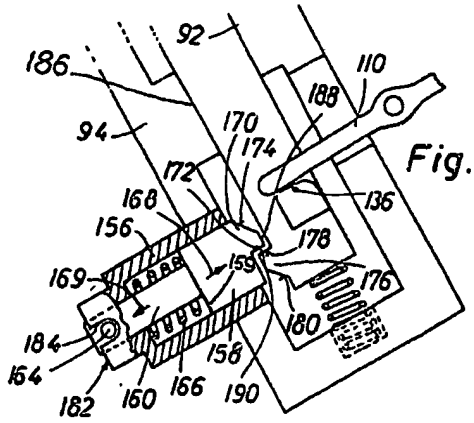
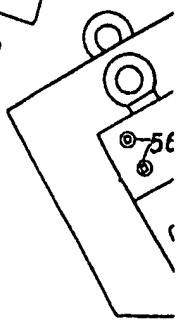


Fig. 5





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882,125 COMPLETE SPECIFICATION

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SHEET 1

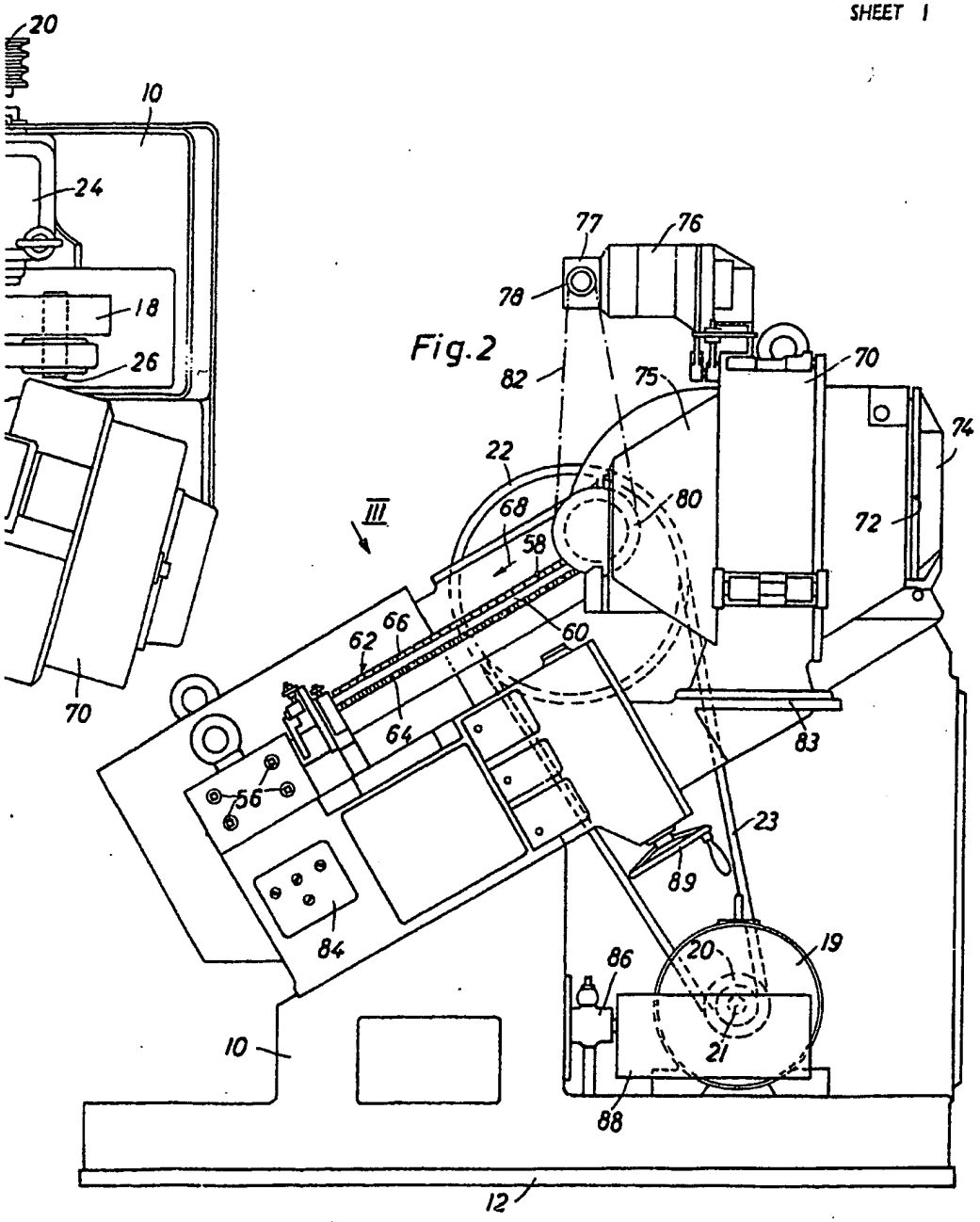

Fig. 2

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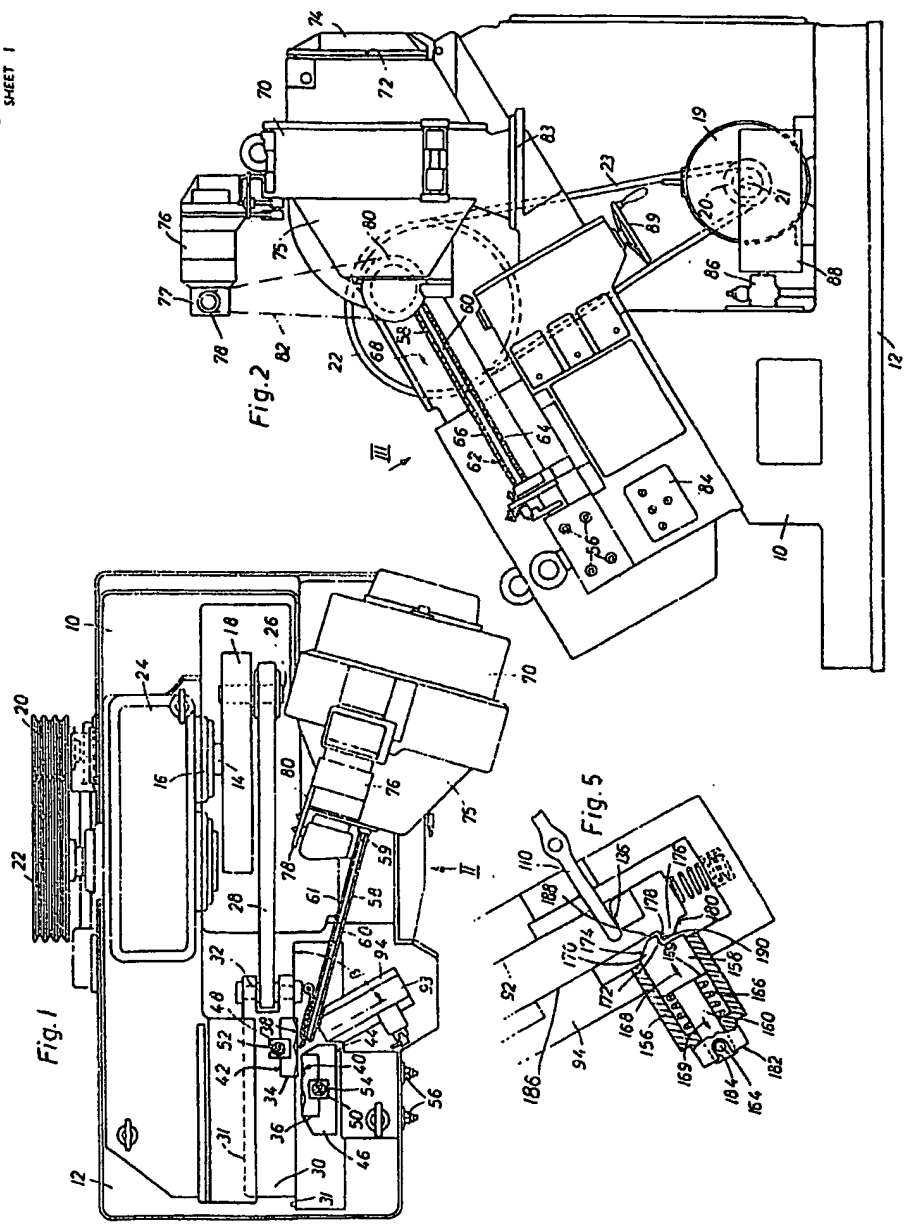
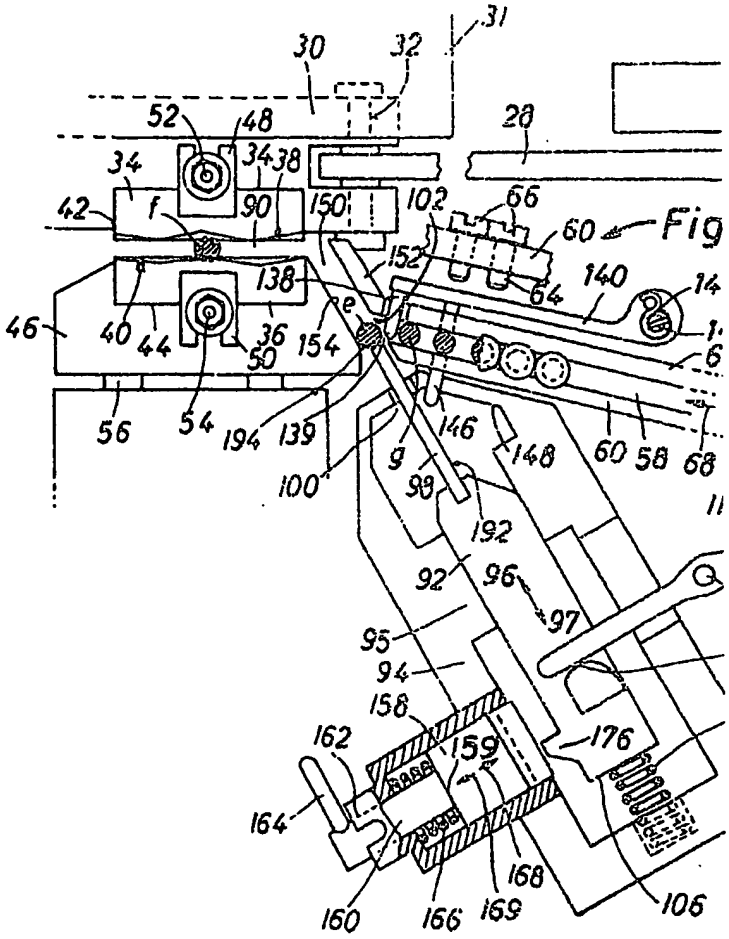


Fig. 1

Fig. 2

Fig. 5



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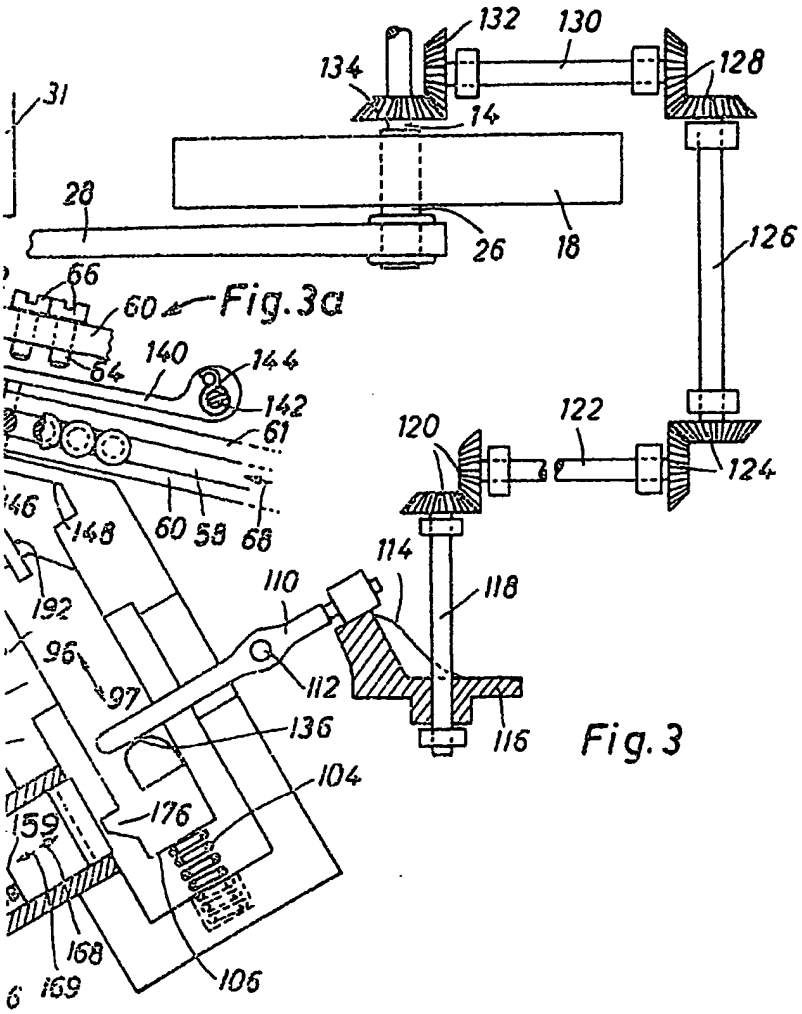

Fig.3a

Fig.3

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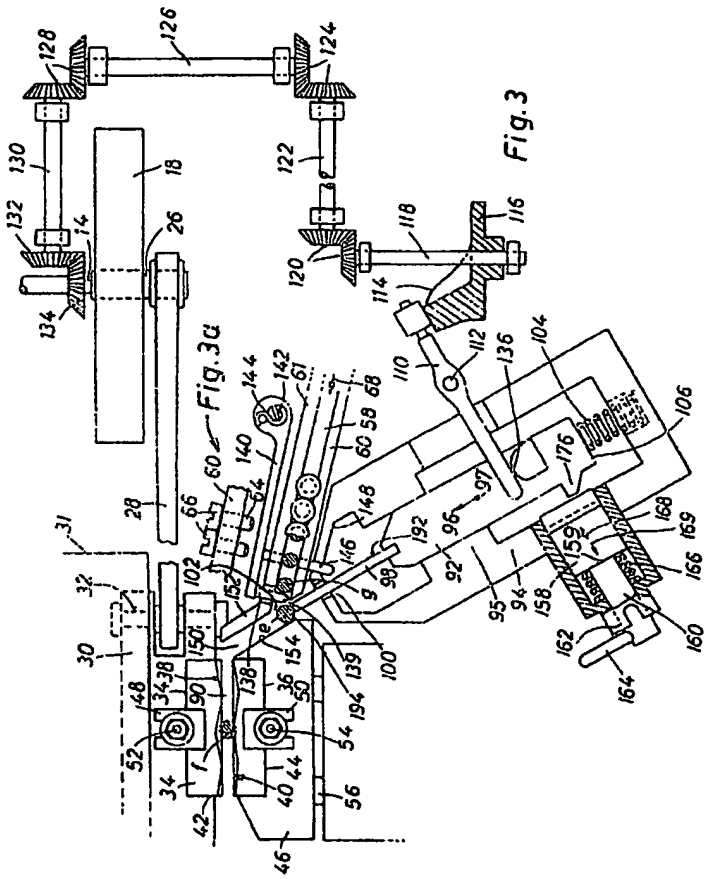
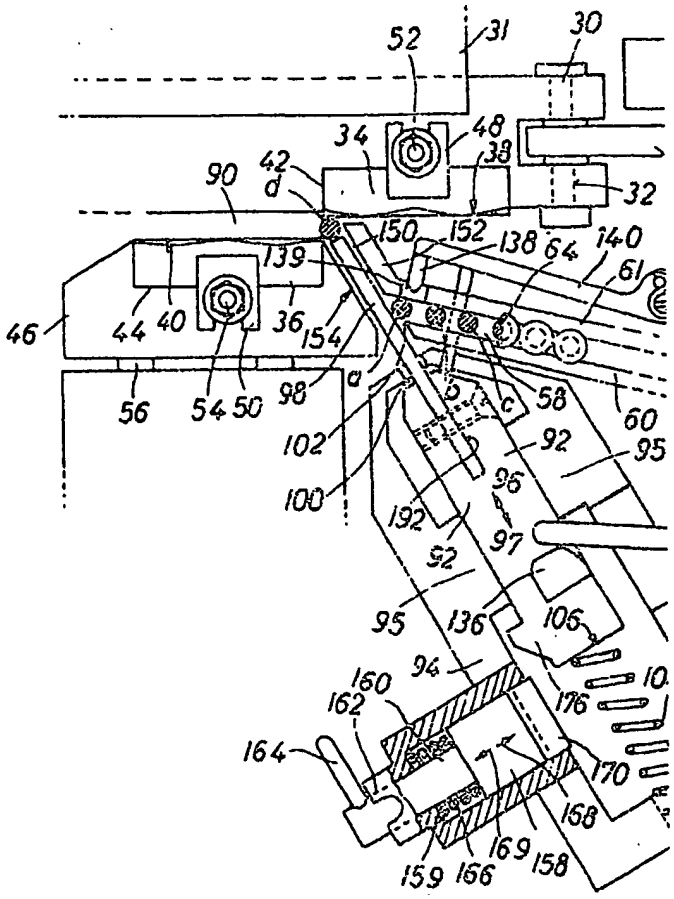


Fig.3



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SHEET 3

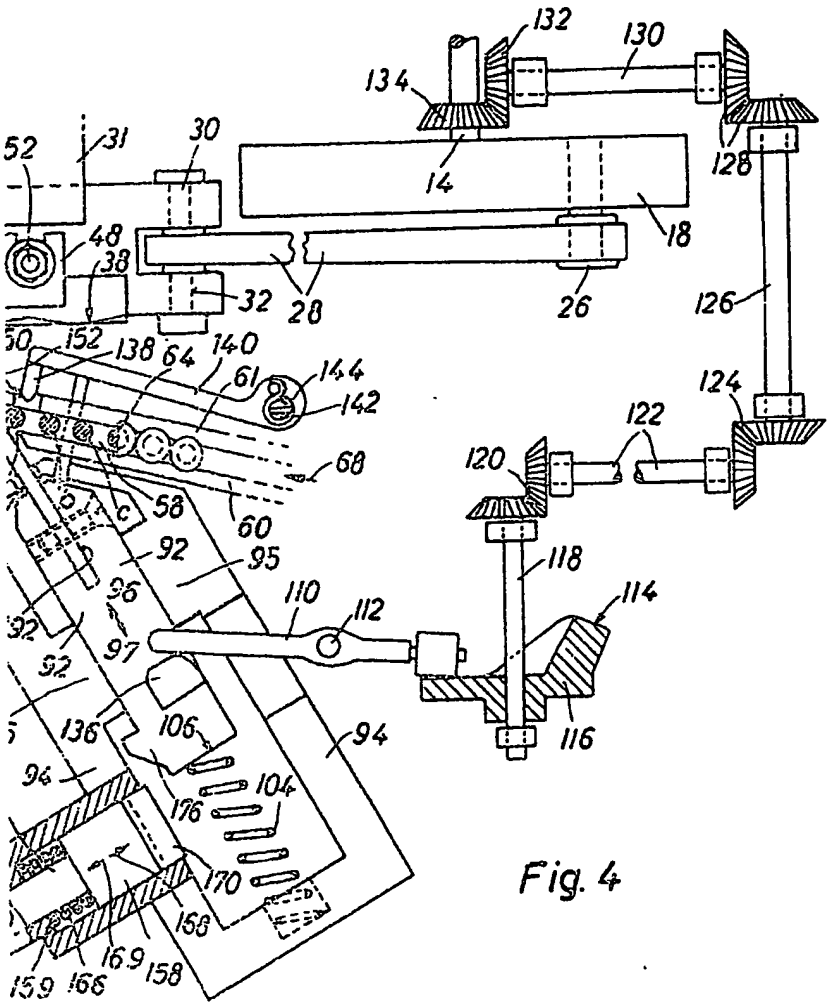

Fig. 4

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SHEET 3

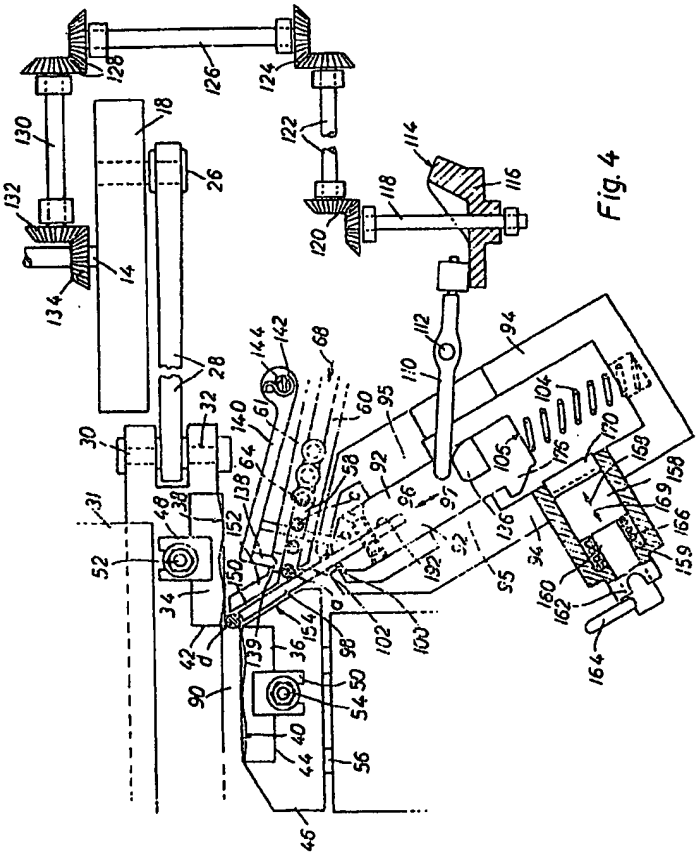

Fig. 4